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HINTS AND METHODS FOR THE USE OF TEACHERS.

(Continued.)

GEOGRAPHY—CONTINUED.

The following suggestions are taken from the *Letters from a Teacher*, in Mass. Com. Sch. Journal vol. III.

How to teach the points of the Compass.

Let your scholars stand facing the north, and then place your map of the town in the proper relation with the points of the compass, and direct their attention to such a farm designated upon it as being north of the school-house, such others as south, east or west. Tell them the sun rises in the east and sets in the west, and if they ever wish to know the points of compass, at any new place where they may find themselves, they can ascertain it by looking at the sun and observing the direction of his apparent motion. If you can obtain a mariner's compass, or even a magnet, you can show them how the north can be ascertained, even when the sun does not shine, or at night, by the direction of a magnetized needle lying upon the surface of water in a bowl. You can at least tell them of this fact, and the use made of it by sailors, and the consequences of its discovery, 400 or 500 years ago.

It is well to mention the names of a few countries, in connection with the points of compass, while your scholars are standing in the proper position. to point in the direction in which they actually lie, and also to advise them always to place their maps thus when they consult them, if they can conveniently do so.

How to find the North Star.

Of course, you know where to look for the north star, as well as which way to go to your school-house; but to excite the interest of your scholars, you may tell them that if, on any bright evening in the year when the stars are out, they will stand on the steps of the church, which faces the north, and look in the direction of Colonel T.'s barn, they will see, on the right-hand corner of the roof, a bright star. There it appears at all seasons and at all hours, and it is called the *polar star*, because it is directly opposite the north pole of the earth, which, in all its revolutions, forever points to that spot. Two stars, nearly in the middle of the Great Bear, always point directly to this polar star, and are, for this reason, called the "Pointers." Sometimes they stand above it, sometimes below it, sometimes on one, and then on the other side of it, because this constellation is seen in different positions by us, as we revolve with the earth, but precisely in that same spot, in relation to the polar star. In the most ancient times of which we have any history, as well as much later in point of time, men guided their small vessels, and were directed even in their journeys by land, through forests and across deserts, by this star. It did not always answer the purpose, because it was sometimes obscured by clouds, but it was all the guide men had, (I mean those men who lived far enough north to see it at all times,) till the discovery of the magnetic needle, which points to the north in all weathers, and under all ordinary circumstances. You can illustrate the relation between the earth and polar star by fixing upon the wall, in a straight line from the north pole of your globe, as it hangs suspended, a bit of colored paper, and then turning the globe in your hands, in such a manner that your pupils will see the pole remain ever opposite to the star. You can do even more than this. Sketch upon a large sheet of paper the constellation of the Great Bear and the Little Bear, in their proper relations for the time of the year, and place this upon the wall opposite the north pole of your globe.

How to make and use Outline Maps.

If your pupils have no globes, you must proceed directly to teaching them from maps, which may be prepared upon cloth, so as to answer your purpose extremely well. The cloth used for these maps, should be of a compact texture, and *cut by a thread*. Jean is best. Let it then receive the impressions of the pencil, the pen, or the paint-brush. As you will wish to suspend these maps by the wall, it is desirable that they should be projected on quite a large scale; and also that the proportion of their relative sizes should be observed. In common atlases, the map of Asia occupies a page no larger than the map of Europe; but you can preserve the proportions better when you make your cloth maps. If Asia is drawn upon a square of one yard and a half, which is the widest cotton you can buy, Europe should be drawn upon one less than three quarters of a yard square. To project a map of the two hemispheres on the same scale as a map of a yard and a half square for Asia, you would require a surface nearly ten times that size; but to prepare such a map would be inconvenient, if not impracticable; and, therefore, it is as well to take the yard square, and trace merely the outlines of continents and kingdoms upon that space, explaining to your pupils, when you show it to them, why it is so wholly disproportionate to the others, and what the size would be if correct. Upon these pieces of cloth draw the parallels of latitude and meridians of longitude, according to the projection of the atlas which you have, only altering the proportions according to the relative size of the continents. If you examine the maps of South America and Asia, for instance, in a common atlas, you will observe that the parallels of latitude are twice as far apart in the one as in the other. Let yours be equal in both, since you are not confined to pages of a certain size. Six maps,—Asia, Europe, Africa, North America, South America, and a map of this State upon a large scale,—will be sufficient for all the teaching of geography in your school.

If you have never drawn any maps before, you may be somewhat puzzled about the method of enlarging them.—The simplest way is to divide the map in your atlas into squares of half an inch, then draw the same number of squares upon your cloth, making them twice, three or four times larger, according to the size desired for your cloth map. After you have done this, and traced the boundary lines on the cloth, observe the position of the parallels of latitude and meridians of longitude, and graduate each one *separately*, from each one upon the atlas. For instance, in drawing the map of South America, you will observe that the meridians are further apart at the equator, than at the northern and southern extremities of the map. If your map is three times as large as the printed map, make the distance of these meridians at the equator three times as great; and so at the top and bottom of the map. Follow the same method in regard to the parallels of latitude.

If, at first, you draw only the outlines of countries, lakes, seas, rivers, and the larger islands, you can add, at your leisure, the names of cities, towns, &c. I have no names written upon my cloth maps, because all my pupils have atlases to refer to, and I allow them to look at the cloth maps where they recite lessons learned from the printed ones. Let the names and relative positions of all the countries in the world be learned first; because you will be able, from the time these are learned, to refer to any places of which you may be speaking or reading, with some hope of attaching associations to them, which will make them easily remembered. Then teach mountains, seas, bays, and gulfs, then large rivers, and so on through the smaller features of the map. The names of cities and great towns should be learned carefully, in connection with their latitude and longitude, especially if you found it impracticable to give such lessons on the globe.

I will suppose your maps to be completed in their outlines. If you have covered them with names, this will be an assistance to you, especially if you are not perfectly familiar with the situation of places; but when your maps are suspended by the wall, and your scholars ranged in their seats before them, they will not be able to distinguish these names. They must learn the situation of countries and natural features, by their shapes and positions, which you can indicate with the help of a long rod or pointer. And here

you will need all the resources of your reading to teach geography worthily; for you should associate with these forms and locations, every thing you know relating to their history, manners, customs, and productions.

How to make a Terrestrial Globe.

I advise you to have a globe, be it ever so rude a one.—You cannot expect to obtain one from your school committee, but you can have a large wooden ball made, upon which you can yourself paste white paper, and draw any thing you wish.

[The following still cheaper way of making a globe is from *Dwight's School-masters Friend.*

You have seen pumpkin lanterns—yes, and made them too; and so have your boys. Well, let nothing prevent you from having a globe of some kind or other in the school. If you can do nothing else, get a ripe pumpkin, open a hole in it, make it hollow, and scrape the shell thin with a large spoon or something else. Mark lightly the lines of longitude and latitude, and more heavily the equator, tropics, polar circles, zones, &c. if you think proper. Mark the continents, and principal islands, rivers, lakes, mountains, &c,, and then pare off the rind to show either land or water. If the shell is made thin enough for light to shine through, you can light it in a dark afternoon with a lamp put inside. (There must then be a hole at the top also to let out the smoke.)

Globes of this kind would probably be made by some of the children. And this should be encouraged. Whoever will attempt to make a globe, will necessarily learn things of the earth or the heavenly bodies spontaneously, which it is often difficult for a master to teach. It is very likely that some of your pupils might soon rival yourself in such manufactures—and well it will be for yourself and the school if they do.

It will be well to draw one or two things, at a time, and explain these clearly before you add any thing else. By so doing, you will have one advantage in not beginning with a globe fully drawn; for the confusion of lines is often very puzzling to beginners.]

If your globe can be perforated at the poles, you can immediately suspend it in your school-room by a string, at the proper angle of inclination, telling your scholars that the earth moves in this manner round the sun. Let the equator be drawn upon it with a black line, the ecliptic with a red one, and explain these lines distinctly before you trace another upon your globe. The equator divides the earth equally into two parts; and, if the poles of the earth were not inclined in the manner thus shown, the equator would always be directly under the perpendicular rays of the sun. But, owing to this inclination, some portion of that region through which the ecliptic passes, and which extends to the distance of about 1400 miles on each side of the equator, comes, in the course of each year, directly under these perpendicular rays. The countries situated there are warmer than any others, because all the force of the sun's beams is concentrated where they strike perpendicularly, or nearly so, and are reflected back into the atmosphere at the same angle. This ecliptic is sometimes called the orbit of the earth, because it shows the direction in which the earth moves.

If the earth moved round the sun, in such a manner that the equator were directly under the sun, the days and nights would be 12 hours long every day in the year, all over the globe, except at the poles, where it would be perpetual daylight, the sun being perpetually visible, just above the horizon, to the people who might live there.

The changes of day and night are caused by another motion of the earth,—its turning upon its own axis every day. This you can exemplify with an apple, or a ball of yarn penetrated through the centre by a knitting needle; and I have sometimes thought this a better aid than a complete tellurium, such as I now have in my school-room, because the latter is so complicated, that it is difficult to make children discriminate among the various motions they see, the one you happen to be explaining. This motion of the earth on its axis brings every part of its surface into the sunlight once in every twenty-four hours, except at and near the poles, which places are shaded half the year, in consequence of the inclination of the earth's orbit before mentioned. At the poles, then, there is but one day in the year, or six months of darkness followed by six months of light. By sticking a pin upon any spot on your apple, and saying that shall represent a man living in that place, you can hold it before the face of any of your pupils, calling him you select, the sun, and turning the apple on its axis, make him clearly understand that that man must be in the dark when turned to the other side by the revolution of the apple. Be careful to turn the apple the right way, that the pin may return opposite the scholar on the upper side of the apple, as this will show him why the sun appears to rise in the east. He will see that it is in reality the earth, which, by its revolution, brings its different portions of surface into the sunlight.

For your next lessons, let the tropics be drawn, and also the boundary lines between the temperate and frigid zones. After what you will already have said of the differences of climate, the words *torrid*, *temperate*, and *frigid* zones, will easily be remembered. You can remark here, that where the ecliptic touches the tropics on either side of the equator, the points are called the *solstitial points*. The sun is directly over the tropic of Cancer on the twenty-first of June. That day is the longest in the year on the northern side of the equator. He is directly over the tropic of Capricorn about the twenty-second of December, which is the shortest day on the northern side. On the southern side, the longest and shortest days are exactly reversed. It will be well now to trace the outlines of the continents, and mention the zones in which they are located.

The next things to be explained are the parallels of latitude and the meridians of longitude. Latitude is the distance of a place from the equator, north or south, and that it can never be more than 90 degrees, because the distance from the equator to either pole measures exactly a quadrant, as they will see by comparing the circle you have divided, with the globe. The parallels, (which you will have already drawn at intervals of 10 degrees,) are thus drawn for the convenience of counting the latitude. All the places on one of these parallels are, of course, at the same distance from the equator and are all east or west of each other. This you can exemplify by cutting a slip of paper long enough to reach from the equator to any one of these parallels; then move it round the globe, and they will see that all the places which fall under the end of it, are at the same distance from the equator, and also at the same distance from the pole. Other lines may be drawn, or imagined, parallel to these; but with the assistance of these alone, the latitude of any place may easily be found.

You now require a meridian upon your globe. One of pasteboard will answer your purpose, though it may not be as convenient as an upright one of brass. Cut a slip of pasteboard that will encompass your globe entirely, and divide it carefully into 360 equal parts. Then fasten it upon your globe with a tack, at each pole, the tack having a large, flat head, so that your globe will revolve within the pasteboard meridian, without tearing it. Now begin at the equator, and mark the number by tens on each quadrant, counting towards the poles. These numbers must coincide with the parallels of latitude already drawn. Explain how, by the assistance of this meridian, the latitude of every place marked on the globe may be accuratetely reckoned. You can let each of your scholars satisfy himself, by trial, mentioning yourself some points of the continents, which they can bring to the meridian, and whose latitude they can reckon themselves.

You are now ready to speak of Longitude. This means the distance of a place east or west from any particular spot, as London or Washington; and it must be reckoned on the equator. The equator must be carefully divided into 24 parts of 15 degrees each, which will make 360 in the whole, letting the numbers run each way as high as 180.—Begin at London, or at Washington, because these are the two places from which longitude is reckoned on our globes and maps. You may easily show that no place can be more than 180 degrees east or west of any particular meridian, because, if a place were more than 180 degrees west, it would then be in east longitude. Through the divisional points, that is, at every 15th degree, draw meridians to the north and south pole. The word *meridian* comes from a Latin word, which means *midday* or *noon*. As the earth turns on its axis, all the places where the sun shines, and which have the same meridian, can see him at the same time. It will be 12 o'clock at noon, therefore, at the same time in all those places. To illustrate this, stick a row of pins upon one of your meridians, and turning it towards any particular scholar, ask him if they are not all opposite his face at the same time. He will see that it is so, and that if he were the sun, he would shine upon them all at once. Thus all the places on our meridian are exactly north or south of us, and the clocks in all such places are exactly like ours; that is, it is 12 o'clock at noon, at the same moment, in them all. If our clock is out of order, we must not set it by the watch of a person who has just arrived from a place either east or west, but we may do so by that of a person who comes from the north or south; that is, from a

place through which the same meridian runs. Now say that you have drawn meridians all around the globe, with intervals of 15 degrees, because every 15 degrees answers to one hour of time, and by this means they can calculate the time at other places. For instance, at a place on the next meridian, or 15 degrees east, the sun will rise an hour earlier; at a place on the next meridian, west, it will rise an hour later; for the earth, in its revolution on its axis, will bring all places east of us into the sunlight earlier than those west of us, as the earth turns from the west to the east. It will consequently be 12 o'clock an hour sooner at all places 15 degrees east of us, &c. As every 15 degrees is equal to one hour of time, every degree is equal to four minutes of time, (60 divided by 15 being equal to 4.)

If you can obtain a thin, circular slip of wood, which will exactly fit your globe, you can easily make an horizon, as it is called, which you can occasionally fasten upon it. A slip of very stiff pasteboard, or millboard, will, however, answer the purpose. Let it be an inch and a half wide, and divide it first into 360 degrees, then into 12 parts, answering to the months of the year. In these divisions, sketch those constellations which compose the signs of the zodiac; or, if you cannot do this for want of a model, place the arbitrary sign of each in the respective divisions with the name of the month in which the sun enters them.

To make a *quadrant of altitude*, cut a slip of stiff paper, 18 1-2 degrees longer than a quadrant of your globe. Divide the portion that extends from the horizon to the pasteboard meridian upwards from 0 to 90 degrees, and downwards from 0 to 18 1-2. It is generally screwed to the brass meridian, but you must move it with your fingers when you wish to use it. The upper divisions are used to determine the distances of places, as mentioned above, and the lower divisions are applied to finding the beginning, end, and duration of twilight; for, owing to the refraction of earth's atmosphere, the sun's slight appears above the horizon when the body of the sun is 18 1-2 degrees below it.

Directions for the use of a Terrestrial Globe.

As some of the Geographies in general use in our Schools contain no explanation and directions for the use of the Celestial or Terrestial Globe, the following extracts are printed from *Woodbridge and Willards Universal Geography.*

The *Terrestrial Globe* exhibits a delineation of all the parts of sea and land, in their proper situations and distances, just as they are in nature.

Each Globe consists of the following parts, viz.

1. The *Two Poles*, or the ends of the axis on which the globe turns, represent the poles of the world. The upper is the North Pole, and the lower the South Pole.

2. The *Brass Meridian*, divided into four quarters, and each quarter into ninety degrees. This circle surrounds the globe and is joined to it at the poles.

3. The *Wooden Horizon* which surrounds the globe. The upper part represents the true horizon, and has several circles drawn upon it. The inner one contains the twelve signs of the Zodiac, through which the sun, or earth, revolves in a year; these are subdivided into degrees; the next circles exhibit the signs of the Zodiac divided into degrees, and the days of the month to which they correspond.

4. The *Hour Circle* divided into twice twelve hours, fitted to the brass meridian, round the north pole. The twelfth hour at noon, is upon the upper part of it, at the Meridian, and the twelfth hour at night is upon the lower part, towards the horizon.

5. The *Quadrant of Altitude*, which is a thin slip of brass, divided into ninety degrees, of the same size of those on the equinoctial line. It may be screwed on occasionally to the top of the brass meridian, to measure the distances of places.

6. The *Mariner's Compass*, usually fixed under the globe. This is a box containing a magnetic needle, and the thirty-two points of the compass.

To find the Latitude and Longitude of any place.

To find the Latitude.—Bring the place to the graduated side of the brass meridian, and the figure that stands over it shows its *latitude*, or distance from the equator. Thus the latitude of London is 51 degrees and a half north—the latitude of the Cape of Good Hope is 34 degrees and a half south.

To find the Longitude.—Observe the degrees the brass meridian cuts on the equator, and that is its *longitude* or distance either eastward or westward. Thus the longitude of the Cape of Good Hope is nearly 18 degrees and a half east. London of course, can have no longitude from itself because the first meridian begins there. Constantinople is 41 degrees N. lat. and 29 degrees E. long. nearly.

The Latitude and Longitude of any place being given, to find that place upon the globe.

Bring the given longitude found on the equator to the brass meridian: look for the given latitude on the meridian, and under the degree is the place sought.

Thus, suppose two ships come to an engagement in 36° 20′ north latitude, and in 32° longitude west from London, you will find it to be in the Atlantic Ocean, a little south of the Azore Islands.

To find the difference of Latitude or Longitude between any two places.

Find the latitude or longitude of each on the globe or map, and count the number of degrees from one meridian or parallel to the other.

Otherwise, 1. If the latitudes or longitudes are both in the *same direction*, i. e. both east or both west, both north or both south, subtract the less from the greater, and the remainder will be the difference.

2. If they are in *different directions*, add them together, and the sum will be the difference of latitude or longitude.

To find the Sun's place in the Ecliptic at any time.

The month and day being given, look for the same on the wooden horizon, and over against the day you will find the particular sign and degree in which the sun is at that time. The sign and degree being noted in the Ecliptic, will be the sun's place, or nearly, at the time desired. Thus, on the 11th of May, the sun's place is in the 21st degree of Taurus.

To rectify the Globe for the latitude of a place.

Move the brass meridian higher or lower, till the pole stands as many degrees above the wooden horizon as the latitude of the place is for which you would rectify. Thus, if the place be London, you must raise the north pole 51 1-2 degrees, (because that is the latitude of it,) which brings that city to the top or zenith of the globe, and over the centre of the horizon.

Note.—In all problems relating to *north* latitude, you must elevate the north pole; but in those that have *south* latitude, you must raise the south pole. And observe, that the north pole must always incline to that part of the horizon marked June, and the south pole to that marked December.

The zenith's latitude must be reckoned upon the brass meridian, from the equator towards the elevated pole, and if the quadrant of altitude be wanted, it must be screwed on there. Thus, for London, it must be so placed as that the graduated edge may cut 51° 30′ of the meridian, because that is the zenith or centre point.

Set the brass meridian of the globe north and south, by the compass, so that the north pole of the globe may be towards the north part of the world, taking care to allow for the variation of the compass.

These things being done, the globe is *rectified*, that is, put into a position similar to the natural situation of the earth, on any given day for the latitude of the place.

To measure the Distance from one Place to another.

Fix the quadrant of altitude over one of the given places, and extend it to the other. This will show the number of degrees between them; which being multiplied by 60, will give the distance in geographical miles. If you would know the distance in English miles, you must multiply the degrees by 69, which will give it very nearly.

To find the true Bearing or Direction of one Place from another.

Rectify the globe to the latitude of one of the places, and bring it to the brass meridian; then fix the quadrant of altitude over that place, and extend it from thence to the other, and the end will point out the direction upon the horizon. Thus, if it were required to know the direction of Rome from London, the globe being rectified, London brought to the brass meridian, and the edge of the quadrant of altitude laid to Rome, you will find the end fall against that part of the wooden horizon marked S. E. or South East.

To find at any Hour of the Day what o'clock it is at any Place in the world.

Bring the place where you are to the brass meridian, set the index to the hour given; turn the globe till the place you want comes under the meridian, and the index will point out what the hour is at that place. Thus when it is six o'clock in the evening in England, it is about half past eight at night at Jerusalem, and nearly one o'clock in the afternoon at Jamaica.

On the Map reckon the number of degrees of Longitude east or west, and put them into hours. Fifteen degrees are equal to an hour; and 1 degree to four minutes. Or, on the Chart of the World, where the meridians are drawn, every 15 degrees, count the number of meridians from one place to the other, and you will have the number of hours difference in their time.

If the place is *East* of the place given, the time of that place is so many hours later than those of the place given; if *West*, so many hours earlier than those of the place given.

To find at what Hour the Sun rises or sets, any day in the Year, and also upon what Point of the Compass.

Rectify the globe for the latitude of the place you are in; bring the sun's place or the day given to the brass meridian, and set the index to 12; then turn the sun's place to the eastern edge of the wooden horizon, and the index will point out the hour of rising; if you bring the sun's place to the western edge, the index will show the time of its setting.

In the *summer* the sun rises and sets to the *northward* of the east and west points, but in *winter* to the *southward* of them. Therefore, when the sun's place is brought to the eastern or western edge of the horizon, you will there see the point of the compass upon which the sun rises or sets that day.

To find the Length of the Day and Night at any time of the Year.

Only double the time of the sun's rising that day, and it gives the length of the night; double the time of its setting, and it gives the length of the day. Thus on the 25th of May, the sun rises at London about four; and sets about eight; therefore the day is sixteen hours long, and the night eight hours.

Or, rectify the globe for the latitude, bring the sun's place to the western part of the horizon, and set the index to twelve at noon; turn the globe eastward till the sun's place comes to the eastern part of the horizon, and the hours passed over by the index will be the length of the day, and the remaining hours will be the length of the night.

For further explanations, see the admirable work from which the above extracts are taken.

ARITHMETIC.*

The following suggestions and methods of teaching the elementary principles of Arithmetic, will be found highly useful.

Counters or Blocks.

Every child should have blocks or counters, that he may practice numbers. He can count them into bands of five and ten, and then consider the collections as units, and count out five fives or five tens. He will practice this for ever, if a little life is put into it. You can say. "I am tired of these little companies of tens, I mean to have a hundred in each company, and get as many as I can muster." Then you can extend his ambition to a regiment, to an army, only let him get the power of treating hundreds, thousands, &c., as units. In the same way let him divide whole numbers, until he looks upon a unit as a collection of parts, large or small, as we please to make them.

"Mamma, I have a great many robins to-day and only one cake: how shall I divide it?" Divide it into as many equal parts as you have robins, and tell me what share each will have.—"Oh mamma, to day I have but three robins; to-day each will be satisfied." And again, "To-day I have six robins and two cakes; will they have more than they had yesterday, or not so much?" It is very unwise to put of fractions so late as we usually do, in teaching arithmetic.—They are as simple and as important as whole numbers; the dividing of a whole thing appeals to children's senses as much as the adding of separate things.

When the children can count, ascending and descending to any extent, I ask how we shall express these numbers. Shall we write as many marks as there are units, or shall we have a different character for each number? How long would it take to count the strokes, or to learn a million of characters? Could the mind grasp so many?

Then I say, "If they will be very attentive, I will teach them to express all numbers, by only ten characters, arranged in different ways. I let them practice with these until they can use them readily; for in arithmetic particularly, one obstacle at a time is enough.

After fixing in their minds that every right-hand figure is a unit, I say: "Now I am going to have a column of tens standing on the left of my units: remember, none must come into this second row but tens, for they will all change into tens the moment they enter."

They now practice addition: at first very thoroughly in the head and then on the slate: they write and recite addition tables, counting them each time.

Then I give sums to add which exceed two figures in the answer, and ask how we shall write the answer. Some can guess that I shall have a row of hundreds.

I detain them on numeration a long while; I give a great part of the time devoted to arithmetic, to obtain the power of conceiving numbers. If the understanding is weak, so much the more need of strengthening it; so much the more danger of confusing it, by offering irregular numbers and complicated relations. Now in these tens and hundreds all is regular: they rise, by the most simple gradation, to the greatest numbers used; the stepping stones are skilfully arranged, and the mind that can reach one, is prepared for the next.

I would give much more time, at first, to secure force and precision of mental grasp, than is usually done. By suitable training, any person might extract the cube root mentally, like Newton, or keep in his memory the first six powers of all numbers from ten to one hundred, like the blind Euler. Captives who have thus kept alive their faculties, show us what may be done even late in life. Far more may be attained when numbers are first presented to the mind; and though few would use their powers for such purposes as Newton and Euler, they would have a clearer conception of distance, space, and all which is the subject of calculation. How few persons can conceive distinctly the extent of a number of more than twelve figures; and how much do many scientific facts lose in sublimity, by this incapacity to grasp them!

It is not merely to improve the power of conception, that I would keep the child so long in numeration. Let him stretch his conceptive faculty a few hundreds, still the series reaches into infinity; and there is no use in his conceiving more than in some science or other he can apply to reality. I should hope also to make his

* See also Connecticut Common School Journal, Vol. I, p. 127; Vol. II, p. 31, 76, 93, 126, 234, 270, 279, 284; Vol. III, p. 67.

idea of the first hundreds and thousands more distinct. He should have an ideal arrangement clear and ready for use; and all numbers should be as familiar to him as the letters of the alphabet. He should write them over and over, every way, skipping, and from dictation, always beginning at the right hand. Meanwhile he should do sums in addition on the slate; and difficult ones, for he would be as familiar with large, as with small numbers.

I would have subtraction practiced in the same manner; going over the same process with a great many different numbers. Thus 30 less 0 is how many? 30 less 1 is how many? up to 30 less 30. I never omit 0 in any of the processes: because children should be able to distinguish between a number taken 0 times, and one with 0 added to it.

The slow recitation of the subtraction table obliges them to keep in their heads two series, an ascending and a descending one, beside a constant number; and thus increases the power of retaining and comparing numbers. At first I ask questions, and each operation is performed slowly, and often on the fingers: but after understanding and practicing them on their slates, they answer with great ease and quickness.

When they are well practiced in subtraction, I set down a very large sum of the same numbers to be added: they think it very tedious, and I agree, and offer to show them a shorter way. I tell them they can do each sum more quickly by carrying part of it, already done, in their heads. I ask them if it would be convenient to gather and grind our corn every time we want bread; or to shear our sheep, and spin and weave the wool, every time we want a frock. I tell them the person can do most in any emergency, and can always exert his powers to the greatest advantage, who has made the best preparation, physically and intellectually: and if they keep their minds amply furnished and in good working order, they can do all which is demanded. Thus if they can multiply all the units as quickly as they can conceive of them, they can multiply the largest sum. Then I begin with 2 taken 0 times, 2 taken once, &c., and go on slowly, making them observe the principle in each instance. I never hurry them in multiplication. If a child could not perceive the working of the rule beyond the first few lines, I would keep him in these a year.

Division comes next; far the most difficult of the first processes, and best explained as analyzing a past process of multiplication; as finding out how often a small number was taken to make a larger one. It requires very great practice particularly when fractions are not taught early.

I often ask the different factors of numbers: this helps to multiply and divide large sums. I draw squares on the board, and show that 12 of them may be arranged, 4 in a line, in 3 lines, or 6 in a line, in 2 lines. I suppose a man buying a cake of 48 lbs.; and then for convenience preferring 2 cakes of 24 lbs.; then I ask if he could take the same quantity in still smaller cakes, and what their weight would be.

Then I go over fractions as thoroughly as I have gone over whole numbers. Colburn's is an excellent book for these, but the transitions from easy to difficult questions are often abrupt, and the teacher must supply exercises. The children do not leave fractions until they can conceive of a number as whole at one moment, and at the next, divided into fractions of any size, and can use these fractions as readily and understandingly as whole numbers.—*Theory of Teaching.*

Numeral Frame.

For our purpose, an old slate frame will answer very well. The vertical sides should be pierced for eleven wires, ten of which should be at equal distances, the eleventh further apart,—say double the distance. On each wire should be placed ten beads, half of one color and half of another,—say blue and yellow,—arranged as follows: three yellow, two blue, two yellow, three blue. Thus we shall have one hundred beads, on ten wires, to represent units, and ten, on the eleventh, to represent hundreds; and so arranged, by twos, threes, fives, and tens, that any number, not exceeding one thousand, can be read off as easily as by the use of ciphers.

Let us now take a class, who cannot count. The teacher, holding the frame so that the beads are all on one side, and passing one of those on the upper wire across to the opposite side, says, "There is one bead. Repeat, after me, one bead; (passing another across,) two beads;" &c., till all the ten are passed across, and named. Then repeat the operation, omitting the word *bead*, till all can readily count from one to ten. This is enough for the first lesson. The second lesson should be a repetition of the first, with this addition: When the three yellow beads are passed across, say, "Now, try to recollect three." Then pass three across on another wire, and ask, how many there are. If they do not know, count the first three again, and repeat, on different wires, till they know three, at a glance. In like manner, make them familiar with four, five, six, seven; and for eight, nine, ten, direct their attention to the other side, as eight on one side may be known by two on the other; nine, by one, and ten, by none. This may probably be too much for the second lesson. The teacher must take care not to fatigue the little pupils, by too long exertion.

As soon as the class has become familiar with the first ten numbers, and able to name them on the frame, at a glance, the difficulty is pretty much over; as the others are chiefly a repetition of the first ten. In teaching them we should, at first, call them by their *original* names, before we introduce the class to their *common*, or *contracted* names, as this will explain the *system* of numbers, which will tend to simplify every part of arithmetic. The class, then, should be told, that *ten* has three different names; namely,

1. One ten, standing by itself, is called, - - ten.
2. One ten, joined to another number, - - teen.
3. More than one ten, - - - - - - - ty.

Applying this to the frame, pass the ten beads on the first wire across, and then say, "There is *ten*." Now, one bead across from the second wire, "There is *oneteen;* another will make *twoteen;* three, *threeteen;* four, *fourteen;*" &c., to nineteen; and, passing the last one across, "Now we have *twoty*." Then, by passing the

beads of the third wire singly across, we shall have, *twoty-one*, *twenty-two*, &c., to *threety*; and, continuing the operation, *fourty*, *fivety*, *sixty*, &c., to *ninety-nine*, the last bead gives *tenty*, or a hundred. We have seen classes, who have gone, at once, from ten to one hundred; and, at the next lesson, could name any number required, on the frame, not exceeding one hundred; and, by telling them that each bead on the eleventh wire stood for one hundred, their knowledge extended to one thousand.

When they have become familiar with the nomenclature, which will be three or four lessons, the abbreviations, which are few and simple, may be explained. The most difficult are the two first, *oneteen*, *twoteen*, which are changed to *eleven*, *twelve*; the others are very simple, namely, *threeteen* and *threety* are shortened to *thirteen* and *thirty*; *fiveteen* and *fivety*, to *fifteen* and *fifty*; lastly, *twoty* is *twenty*; and *fourty* is *forty*.

This explanation is principally intended for those who know nothing of arithmetic. But it would be profitable for the whole school to go over the frame once or twice, as there are few who have clear notions of the meaning of *ty* and *teen*.

Our little pupils, having thus acquired the nomenclature of numbers, the fundamental processes of addition, subtraction, multiplication, and division, may now be commenced. The first two should be taught simultaneously on the frame: thus, passing two beads and two beads, the class will see they make four; and, if two be taken from four, two will remain. If this be practised a very few minutes every day, in a week or two the class will add or subtract, instantly, any two numbers, not exceeding one thousand. Multiplication and division should also proceed simultaneously. Thus, taking eight beads, ask, how many twos it contains; and, if one of the class separate them on the wire into twos, all will see there are four; consequently, four twos make eight, and eight contains four twos. It will not be necessary to go further than the fifth line in multiplication and division; as the higher numbers will be more readily taught from Colburn's 'First Lessons,' of which anon. The frame need now be no longer used as a regular exercise, but should always be convenient to the teacher's desk; as, if properly used, it will be of much advantage to the class.

Palmer's Manual.

Blackboards and Slates—how provided.

As preliminary to the use of slates and blackboards in arithmetic and other studies, we publish the following remarks, from a forthcoming work, on *Slate and Blackboard Exercises.*

A black board, in every school house, is as indispensably necessary as a stove or fireplace; and in very large schools several of them might be useful. They should, in general, be suspended on the wall near the teacher's desk or platform, so as to be, like the latter, in full view of the whole school. Of course they ought to be moveable, that they may be hung up in any part of the house convenient. And though the largest may be six or eight feet long and half as broad—and indeed the larger the better—it is certainly a convenience to have one or two so small and so light that they can be held in the arms like a slate.

Now the word *black board* need not awaken in our minds the thought of any thing difficult, rare, or costly. Why it is simply a black *board*. Is there any difficulty in painting a piece of board black? It is indeed desirable to have the board planed before it is painted, and to have it smooth and soft; but neither in this is there any thing very difficult and mysterious. The greatest difficulty to be encountered is that of finding a single board wide enough; for if we use several pieces, it requires some little tact to frame them together in such a way as to have them answer a valuable purpose; but though even this is not beyond the art of the mechanic.

Many have thought it better to paint black the whole end of the school room, near which the teacher's desk is placed. This would not be so *agreeable*, as a brighter color, nor perhaps, so well for the eye, unless indeed the house was exceedingly well lighted; nevertheless it might answer some purpose. A smaller portion of the wall of suitable size, painted black,—say six or eight feet square of it—would, in my view, be preferable. In either case, however, one or more moveable black boards would be necessary for reasons which will appear in the progress of these exercises.

Slates are as necessary as black boards, and even more so. But they are so liable to be broken, it will be said, as to render it expensive to the parents to keep their children supplied with them. There would be weight in this objection were it not that this liability to injury can be for the most part prevented. 1st, by care on the part of the teacher to withhold the slate whenever the pupils are not sufficiently careful of them. 2, by having the frames made sufficiently strong. A simple band of cord, tin, or wire round each corner, will greatly diminish the liability to injury from falling; but sheet iron fastened tightly around the corners of a good oak frame is much better. Such preparation may seem a little costly at first; but if it were left to my choice to find a school in books or slates, as a means of employment, I should not hesitate on the account of expense to furnish the latter.

For let it be distinctly understood that no common school can thrive well, and the moral and physical character of the pupils be properly attended to, without furnishing the children with ample employment; and I repeat it, I know of no way of employing them so well as by means of slates and pencils. On this subject moreover, I speak from considerable experience.

But are not books necessary at all, when the pupils are furnished with slates? I may be asked. Not for a large proportion of the children who attend our summer schools, nor for some of those who attend in the winter. To such I believe books are not only useless, but on the whole, worse than useless. As they advance in years, however, they may be indulged with a book, now and then as a favor. Such a favor will not be esteemed a light thing; and will come in time, to be sought more frequently, and with more and more earnestness.

It is true we should not allow the pupils to have slates in their hands the whole time. Though it should be our aim to give them constant employment, yet their employment should be varied. Even the slate, if it were at their command continually, would become tiresome. To sit still, at times—entirely still—if not continued too long, is *one form of doing something;* and I consider it as much a part of the teacher's duty to form his pupils to the habit of sitting still, as to teach them spelling and reading. Not of course an hour at a time, or half an hour, or a quarter, even. To some children, five minutes would be long enough; and to most, ten minutes would be the full extent of what would be useful. But there are numerous other exercises which are useful to the young, in the school room; such as standing, marching, singing, &c.; to say nothing of exercises, at least every hour, out of it.

But having black boards and slates, provided for school, what shall be used on them—chalk, crayons, or pencils?

For the black board, a simple piece of chalk will answer very well. There is no objection, however, to what are called, by some, *port crayons.* These keep the chalk from the fingers, and of course from the clothes. By *port crayons*, I mean tin or brass tubes, about as large as a common crayon—or if a little larger, it would do no harm—with two slits at the end, into which a piece of chalk might by pushed, where by the elasticity of the tube, it would be retained with sufficient firmness.

For writing on slates, nothing is better, on the whole, than common pencils. As they are liable to be broken, however, the question has been raised, whether short pieces, which are not so readily broken, should be used, or whether larger ones are not preferable. My opinion is in favor, on the whole, of long ones; and for the following reasons: If the pencil is long, and of a texture sufficiently soft, it will not be difficult to teach the pupil to hold it as he would a pen; and thus he would be preparing to hold his pen properly whenever he comes to write on paper. But if the pencil is short, only an inch or two in length, it will in all probability be held in a very confined, awkward manner; and the pupil will be unfitting himself for holding a pen properly, in time to come. I know well that the habit he acquires of contracting his fingers around the pencil can sometimes be broken; but it is often carried through life.

To prevent them from being broken, the pencils may be wrapped in strong paper covered with paste, which should be well rolled round them and dried. As the pencil wears away, the paper and the stone may easily he cut away together. Or the *port crayons*, or handles for the chalk already mentioned, made a little smaller than a crayon—say about the size of a common quill—may be used; in which case, a longer or shorter piece of pencil will serve the purpose, just as may happen to be convenient. The pencils or crayons should be attached to the slates loosely, by means of strings. In the case of the younger pupils, this will save them from being lost; and in that both the older and the younger will prevent much confusion and noise. The desks of a school room should all be so constructed as to furnish a place for a slate. This, of course, would not prevent the teacher from taking the slates away from them whenever he should deem it best, especially those of the younger pupils.

Perhaps it should be added that a piece of sponge to each slate, and a larger piece for the black board—or if not of sponge, of cloth or wash leather—is as necessary as the slate and black board. The teacher, moreover, needs something for a pointing stick.

I ought also to say here, that the preceding remarks, as well as those which follow, are made upon the presumption that every pupil of every age has his own separate desk; for I conceive this to be a highly important point, in the construction of every school house. Some, I know, undertake to say that one desk will serve for two pupils; and so it may, when we cannot do better. But one pupil, and one only, to each desk, however young he may be, is certainly preferable. The expense of adding a few feet in the length and breadth of a house, in order to admit of space for separate desks, will be more than made up in increase of comfort and facility of progress to the pupils. These desks, moreover, should be at a considerable distance from each other. The reasons are obvious to the teacher. It is better to prevent evil, when we can, than to cause it.

The following method of using the blackboard in the early stages of Arithmetic, is taken from a little work, just published by Perkin's & Marvin, Boston, entitled *The Blackboard in the Primary School.* The book is beautifully got up, and will be found very valuable in the hands of teachers. It does not go far enough. If read however, it will save many teachers the disgrace of not knowing how to use a blackboard.

"The teacher, after making a single mark on the board thus,

inquires,

How many marks have I made?

Adding another mark,

How many marks have I made?

Adding the brace and figure, and pointing to the latter,

2

What is that figure?
How many ones are there in two?
Which is the most, one or two?
Which is the least, one or two?
How much more is two than one?
What is one half of two?
What is twice one?

After rubbing off the brace and figure, and adding another mark,

How many marks have I made?

Adding the brace and figure, and pointing to the latter,

3

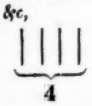
What is that figure?
How many ones in three?
Which is the most, two or three?
Which is the least, two or three?
How much more is three than two?
How much more is three than one?

What two numbers will make three?

After rubbing off the brace and figure, and making another mark,

How many marks have I made?

Adding the figure, &c,



What is that figure?
How many ones in four?
Which is the most, three or four?
Which is the least, three or four?
How much more is four than three?
How much more is four than two?
How much more is four than one?
What is one half of four?

How many twos in four?
What two numbers will make four?
What other two numbers will make four?

A similar process is exemplified up to one hundred.

A Practical Lesson in Addition.

The following examples of a class exercise in Arithmetic is taken from Abbott's Teacher.

The teacher is represented with a class in Arithmetic at recitation, who have just performed an example in addition.

"There are three modes of adding up a column of figures, which I shall describe, and I wish you would notice them carefully and tell me which you practice.

1. "I shall call the first *counting*. You take the first figure, and then add the next to it, by counting up regularly. There are three distinct ways of doing this.

(a.) Counting by your fingers. ("Yes sir.") You take the first figure,—suppose it is seven, and the one above it, eight. Now you recollect that to add eight, you must count all the fingers of one hand, and all but two again. So you say seven—eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen."

"Yes sir," "Yes sir," said the scholars.

(b.) "The next mode of counting is to do it mentally, without using your fingers at all, but as it is necessary for you to have some plan to secure your adding the right number, you divide the units into sets of two each. Thus you remember that eight consists of four twos, and you accordingly say, when adding eight to seven, "Seven;—eight, nine;—ten, eleven;—twelve, thirteen;" &c.

(c.) The third mode is, to add by threes, in the same way. You recollect that eight consists of two threes and a two; so you say, seven;—eight, nine, ten;—eleven, twelve, thirteen;—fourteen, fifteen."

The teacher here stops to ascertain how many of the class are accustomed to add in either of these modes. It is a majority.

2 "The next general mode is *calculating*. That is, you do not unite one number to another by the dull and tedious method of applying the units, one by one, as in the ways described under the preceding head, but you come to a result more rapidly by some mode of calculating. These modes are several.

(a.) Doubling a number, and then adding or subtracting as the case may require. For instance in the example already specified; in order to add seven and eight, you say, "Twice seven are fourteen and one are fifteen;" ("Yes sir," "Yes sir,") or "Twice eight are sixteen, and taking one off, leaves fifteen. ("Yes sir.")

(b.) Another way of calculating is to skip about the column, adding those numbers which you can do most easily, and then bringing in the rest as you best can. Thus, if you see three eights in one column, you say three times eight are twenty-four, and then you try to bring in the other numbers. Often in such cases, you forget what you have added and what you have not, and get confused, ("Yes sir,") or you omit something in your work, and consequently it is incorrect.

(c.) If nines occur, you sometimes add ten, and then take off one, for it is very easy to add ten.

(d.) Another method of calculating, which is, however, not very common, is this. To take our old case, adding eight to seven, you take as much from the eight to add to the seven as will be sufficient to make ten, and then it will be easy to add the rest. Thus, you think in a minute, that three from the eight will make the seven a ten, and then there will be five more to add, which will make fifteen. If the next number was seven, you would say five of it will make twenty, and then there will be two left, which will make twenty-two. This mode, though it may seem more intricate than any of the others, is in fact more rapid than any of them, when one is little accustomed to it.

These are the four principal modes of calculating which occur to me. Pupils do not generally practice any one of them exclusively, but occasionally resort to each, according to the circumstances of the particular case."

The teacher here stopped to inquire how many of the class were accustomed to add by calculating in either of these ways, or in any simpler ways.

3. "There is one more mode which I shall describe: it is by *Memory*. Before I explain this mode I wish to ask you some questions which I should like to have you answer as quick as you can.

How much is four times five?—Four *and* five?
How much is seven times nine?—Seven *and* nine?
Eight times six?—Eight *and* six?
Nine times seven?—Nine *and* seven?"

After asking a few questions of this kind, it was perceived that the pupils could tell much more readily what was the result when the numbers were to be multiplied, then when they were to be added.

"The reason is," said the teacher, "because you committed the multiplication table to memory, and have not committed the addition table. Now many persons have committed the addition table, so that it is perfectly familiar to them, and when they see any two numbers, the amount which is produced when they are added together comes to mind in an instant. Adding in this way is the last of the three modes I was to describe.

Now of these three methods, the last is undoubtedly the best. If you once commit the addition table thoroughly, you have it fixed for life; whereas if you do not, you have to make their calculation over again every time, and thus lose a vast amount of labor.

We will therefore study the addition table now, in the class, before we go on any farther."

A Method of Teaching Linear Drawing, *adapted to the Public Schools*. Boston: E. P. Peabody. Hartford, Tyler & Porter.

If we had received a copy of this admirable little work earlier we should have enriched our columns with extracts, under appropriate head. It is just what is wanted for teaching Linear Drawing.

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